

### REMARKS

The Examiner's Final Office Action of October 10, 2003 has been received and its contents reviewed. Applicants would like to thank the Examiner for the consideration given to the above-identified application.

Claims 1-8 were pending in the present application prior to this Amendment of which claim 1 is independent. By this Amendment, claims 1, 3, 5-8 have been amended. Accordingly, claims 1-8 are pending for consideration. In view of these actions and the following remarks, reconsideration and allowance of this application is now requested.

#### **I. Rejections of Claims 1-2 and 5-8 Under 35 U.S.C. 103(a)**

By this Office Action, claims 1, 3 and 5-8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,113,685 to Wang et al. (hereinafter "Wang") in view of U.S. Patent No. 6,426,519 to Asai et al. (hereinafter "Asai"). For the reasons discussed below, reconsideration and withdrawal of the rejection of claims 1-8 is requested.

As herein amended, independent claim 1 is directed to a method of manufacturing a nitride semiconductor substrate, comprising (i) a first step of selectively forming a raised and recessed region in an upper portion of a base substrate; (ii) a second step of growing a semiconductor layer of nitride on the raised and recessed region in said upper portion of said base substrate so that a recessed portion in said raised and recessed region is filled and the upper surface thereof is even; and (iii) a third step of irradiating an interface between the semiconductor layer and the base substrate with a laser beam, thereby separating the semiconductor layer from the based substrate to form a semiconductor substrate from the semiconductor layer, wherein in the third step, the laser beam is irradiated upon the semiconductor layer from the surface opposite to the upper portion of the base substrate, while stress is being generated at the interface between the top portion of the raised portion of the base substrate and the semiconductor layer. Support for this amendment is found on at least page 18, lines 24 to page 19, lines 24 and FIG. 3B.

When, as in the recited third step of amended claim 1, the laser beam is irradiated upon the semiconductor layer from the surface opposite to the upper portion of the base substrate and the semiconductor layer, stress concentrates at the region 30 connecting the upper surfaces of the adjacent raised region 11b of the substrate 11 in the semiconductor

layer 13. (See Application, FIG. 5). Furthermore, since semiconductor layer 13 has a small thermal expansion coefficient, the presence of the base substrate 11 having a greater thermal expansion coefficient than the semiconductor layer 13 at the interface causes the first stress 31 in the direction of expansion. Thus, the region of the semiconductor layer 13 filling the groove 11a of the base substrate 11 contracts. As a result, the first stress 31 and the second stress 32 act to cut the semiconductor 13 from the upper surface of the raised region 11b in the semiconductor layer 13 in the direction parallel to the main surface. Generating stress at the top portion of the raised portion of the base substrate and the semiconductor layer, in accordance with the method of amended claim 1, allows for the manufacture of nitride semiconductors substrates without cracks extending perpendicularly to the main surface of the substrate 11 in the semiconductor layer 13 during laser beam irradiation. The crystallinity of the nitride semiconductor prepared in accordance with the method of the claimed invention, therefore, is substantially improved relative those prepared in accordance with known methods.

With respect to Wang, disclosed is a GaN layer 10 formed on material 11 which is selectively formed on a substrate 12, and subsequently the GaN layer is removed from the substrate by irradiating a back surface of the substrate with a laser beam. Wang also discloses a stress relief between the substrate and the GaN layer (See Wang, Col. 3). It is respectfully, submitted, however, that Wang fails to disclose where the stress relief occurs. In particular, Wang fails teach or suggest the method of manufacturing a nitride semiconductor substrate of amended claim 1 comprising, *inter alia*, a third step of irradiating an interface between the semiconductor layer and the base substrate with a laser beam, thereby separating the semiconductor layer from the based substrate to form a semiconductor substrate from the semiconductor layer, wherein in the third step, the laser beam is irradiated upon the semiconductor layer from the surface opposite to the upper portion of the base substrate, while stress is being generated at the top portion of the raised portion of the base substrate and the semiconductor layer.

Asai fails to remedy the deficiency of Wang. Asai merely discloses that a GaN layer is formed on a substrate on which a trench is formed. If a back surface of the substrate is irradiated with a laser beam, Asai fails to disclose where stress relief occurs in the substrate and where a semiconductor layer is separate therefrom. In particular, Asai also fails to teach

or suggest the method of manufacturing a nitride semiconductor substrate of amended claim 1 comprising *inter alia*, a third step of irradiating an interface between the semiconductor layer and the base substrate with a laser beam, thereby separating the semiconductor layer from the based substrate to form a semiconductor substrate from the semiconductor layer, wherein in the third step, the laser beam is irradiated upon the semiconductor layer from the surface opposite to the upper portion of the base substrate, while stress is being generated at the top portion of the raised portion of the base substrate and the semiconductor layer.

In view of the foregoing, Applicant submits that each and every element of the claimed invention is not taught or suggested by Wang or Asai, either taken alone, or in combination. Accordingly, a *prima facie* case of obvious under 35 U.S.C. 103(a) has not been established. Reconsideration and withdrawal of the rejection of independent claim 1 in view over Wang in view of Asai is requested.

Inasmuch as claims 2 and 5-8 are dependent on independent claim 1 and inherently include each and every element thereof, the foregoing arguments with respect to claim 1 are also applicable to claims 2 and 5-8. Accordingly, reconsideration and withdrawal of the rejection of claims 2 and 5-8 are also requested.

## **II. Rejection of Claim 4 under 35 U.S.C. 103(a)**

Claim 4 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Wang in view of Asai, as applied to claims 1-3 and 5-8, and further in view of U.S. Patent No. 6,348,096 to Sunakawa et al. (hereinafter "Sunakawa"). For the reasons discussed below, reconsideration and withdrawal of the rejection of claim 4 is also requested.

Claim 4 is dependent upon amended claim 1 and, therefore, is deemed to include each and every limitation of claim 1. Applicant respectfully submits that, for the reasons discussed above with respect to the rejection of claims 1-3 and 5-8, Wang and Asai are improper reference against the claim 4.

Sunakawa fails to remedy the deficiencies of Wang and Asai. Contrary to the present invention, Sunakawa merely provides a mask that is selectively formed on a substrate, on which is formed a GaN layer. Like Wang and Asai, Sunakawa fails to teach or suggest where stress relief occurs in the substrate. In particular, Sunakawa fails to teach or suggest a method of manufacturing a nitride semiconductor substrate of claim 4 comprising, *inter alia*,

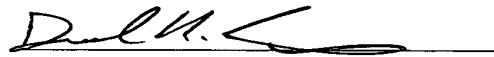
a third step of irradiating an interface between the semiconductor layer and the base substrate with a laser beam, thereby separating the semiconductor layer from the based substrate to form a semiconductor substrate from the semiconductor layer, wherein in the third step, the laser beam is irradiated upon the semiconductor layer from the surface opposite to the upper portion of the base substrate, while stress is being generated at the top portion of the raised portion of the base substrate and the semiconductor layer.

Accordingly, Wang, Asai and Sunakawa, either taken alone or in combination fail to teach each and every element of claim 4 as required for a *prima facie* case of obviousness under 35 U.S.C. 103(a). For the foregoing reasons, reconsideration and withdrawal of the rejection of claim 4 is respectfully requested.

#### CONCLUSION

Having responded to each and every rejection set forth in the outstanding Office Acton, it is submitted that claims 1-8 are now in condition for allowance. An early and favorable Notice of Allowance is respectfully solicited. In the event that the Examiner is of the opinion that a brief telephone interview will facilitate the allowance of one or more of the above claims, the Examiner is courteously solicited to contact the Applicant's undersigned representative at the telephone number below.

Respectfully submitted,



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